ADM
4

Eric
Comment?

He's right! Tom
May I have this copy

ay, new york, n.y. 10018 · (212) 868-1220

June 28, 1971

TO: X3 Members

FROM: J. F. Auwaerter

SUBJECT: Code Extension Standardization and Product Conformance to ANS X3.4 - 1968 (ASCII)

This document is intended to direct the attention of the members of X3 to a problem which has arisen from a painfully slow standardization effort coupled with a rapidly expanding technology.

Manufacturers have been forced to make ad hoc decisions for new products requiring expanded character sets in the absence of standardized code extension procedures. In many cases these products, which employ character substitutions, are erroneously referenced as in conformance with ASCII; ASCII (ANSI X3.4 - 1968) specifically states that "character substitutions will result in a coded character set which does not conform to this standard."

The May, 1971 issue of the Auerbach Reports identifies 12 manufacturers that purport to have machines that generate ASCII whereas in fact they are "secular sets." The twelve manufacturers differ from ASCII in the following areas:

a) New controls are substituted for the existing controls (column 0 and 1). These include many controls for CRT terminals.

b) New symbols are substituted for the graphics in column 2.

c) New controls and symbols are substituted for the graphic in position 4/0 and the graphics in positions 5/11 through 5/15. These also include many CRT controls.

d) New controls and symbols are substituted for the graphic in position 6/0 and the graphics in positions 7/11 through 7/14. Additionally many CRT controls are substituted for the lower case alphabetics (column 6 and 7).

NMAH 311/6

The need for expanded character sets has been known by X3 for a number of years; a basic code extension procedure was proposed as far back as 1962.

The urgency and importance of this matter is confirmed by Mr. John Fletcher in his document to X3L2 (X3L2/1121) in which he states:

> "...LRL has been forced to select a set of its own; however, the selection has been based on an informed estimate of the direction that standardization will take."

Not all manufacturers are fortunate enough to have members on ANSI Sectional or Technical Committees.

In view of the above, I urge that the members of X3 assign the highest priority to the advancement of a code extension standard. Additionally, I suggest the Chairman of X3 explore with ANSI means of assuring that manufacturers of non-conforming products remove from published material the references to conformance with AN Standards.

John Auwaerter

IEEE Representative to X3,
Communications Group

June 11, 1971

IDENTIFICATION OF TERMINAL MANUFACTURERS

1. Atlantic Technology Corporation
   Model 2000 Display Terminal

   Address Function Code substituted for ACK
   End Symbol substituted for !
   Check Symbol substituted for "
   Return to Alpha Control substituted for @
   Start Symbol substituted for]
   @ substituted for '
   ! substituted for ¦
   | substituted for tilde

2. Bunker Ramo Corporation
   Series 2200 Display Terminal

   / substituted for ¦

3. Burroughs Corporation
   Input Display System

   ≥ substituted for !
   ≤ substituted for '
   x substituted for /
   ≠ substituted for ^
   ← substituted for ___
   \ substituted for grave

4. Computer Communications Incorporated
   CC-30 Station

   INT substituted for ENQ
   Left Arrow substituted for Backspace
   Right Arrow substituted for Horizontal Tab
   Downward Arrow substituted for Vertical Tab
   Reset Character substituted for Form Feed
   Parity Character substituted for NAK
   Clear Character substituted for EM
   Upward Arrow substituted for SUB
   Tab Character substituted for FS

5. Data 100 Corporation
   Batch Terminal

   Left Edge Character substituted for Quotation
   Period Character substituted for Pound Sign
   Intregal Character substituted for Dollar Sign
   Dash Character substituted for Circumflex

6. Delta Data Systems Corporation
Delta 1 Video Display System

- Home Character substituted for Form Feed
- DCO Character substituted for DLE
- Upward Arrow substituted for SYN
- Downward Arrow substituted for ETB
- Normal Mode Character substituted for CAN
- Format Mode Character substituted for EM
- Home Character substituted for ESC
- Right Arrow substituted for FS
- A/N Character substituted for RS
- GR Character substituted for US

7. General Electric Company
Data net 760

- Reverse Linefeed substituted for Device Control 1
- Forward Space substituted for Device Control 2
- Page Return substituted for Device Control 4
- Print substituted for SUB
- Left Vertical Line substituted for Left Bracket
- Over Line substituted for Reverse Slash
- Right Vertical Line substituted for Right Bracket
- Blink substituted for Circumflex
- Upper Left Corner substituted for Underscore
- Busy Control substituted for Lower Case o

8. Honeywell EDP Division
Honeywell Data Station

- Control Sample Character substituted for DC1
- Telephone (Operator Signal) substituted for DC2
- Branch Request Signal substituted for DC3
- Deactivate Signal substituted for DC4
- Delay Line Buffer Bypass substituted for ETB
- Reverse Slash substituted for Commercial At
- Tilde substituted for Reverse Slash
- Commercial At substituted for Grave

9. IBM Corporation
Model 2260 Display Station

- Commercial At substituted for Grave
- Upper Right Hand Corner substituted for Broken Vertical Line
- Vertical Line substituted for Tilde
- Start MI Character substituted for Right Bracket

10. Philco Ford Corporation
Model D-20 Display Terminal

Diamond Character substituted for Exclamation Mark
Box Character substituted for Quotation Marks
Circumflex substituted for Commercial At
Tilde substituted for Reverse Slash
Start of Entry Character substituted for Right Bracket
Upward Arrow substituted for Circumflex

11. RCA Corporation
Model 70/750 Display Terminal

Data Format On Character substituted for Shift Out
Data Format Off Character substituted for Shift In
Multiplication Character substituted for Reverse Slash
Divided By Character substituted for Right Bracket
Cent Symbol substituted for Left Brace
Lozenge Symbol substituted for Right Brace

12. Sanders Data Systems Incorporated
Model 620 Display System

Front Space substituted for Backspace
Right Pointing Triangle substituted for Shift Out
Left Pointing Triangle substituted for Shift In
Request to Send Character substituted for DC1
Request to Receive Character substituted for DC2
Backspace Character substituted for CAN
Dot Character substituted for Pound Sign
Hard Copy Control substituted for Grave
Type Control substituted for Lower Case b
Format Type Control substituted for Lower Case c
Send Control substituted for Lower Case i
Clear Control substituted for Lower Case j
Reset Cursor Control substituted for Lower Case k
Memory Marker Control substituted for Lower Case n
Conversation Type Control substituted for Lower Case o
Parity Error Control substituted for Delete

american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

Doc. No. X3L2/1228
Date 72-04-18
Project 12 R

COMMITTEE CORRESPONDENCE

cretariat: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466-2288

Reply to: Eric H. Clamons
Honeywell Info. Systems
200 Smith Street
M. S. 453
Waltham, Mass. 02154

Mr. T. E. Wiese
Office of VP for Business
University of Wisconsin
1220 Linden Drive
Madison, Wisconsin 53706

SUBJECT: Conflicts Between ASCII and EBCDIC.

Dear Ted:

In 1968 a compromise was worked out before ASCII was ratified. A 1:1 correspondence was established between EBCDIC and ASCII which in ASCII permitted ! to take on the meaning of logical OR (|) and ^ the meaning of logical NOT (¬). In return, EBCDIC was to replace ¢ by [and ! by]. Unambiguous interchange between the two codes depends on the last: replace ! by] .

As you know, nothing but lip service was paid to the compromise. ASCII users use ! and ^ and EBCDIC users ¢ and ! Meanwhile, PL/I documentation uses ! not | and ¬ not ^ ....What a mess!

Since mostly SHARE (and a little GUIDE) helped get us to where we are i.e., forced us to use the common sense to get the two codes together, I now appeal to you to stir things up to take the last step:

> Please help get the IBM Standard to reflect the 1968 changes in the text (not the appendix).

May I suggest that this change is the least costly of many alternatives. Terminals are notoriously expensive to alter. The majority of terminals use ASCII. In proportion to the monthly rent on a high speed printer, the modification of a chain costs little. It may even cost less if there is a "customer demand".

Please let me know if I can help in any way to bring this phase of code standardization to a conclusion.

Regards,

NMAH 311/7

Eric

Eric H. Clamons
Chairman X3L2

P.S. The Europeans have declined so far to use the | and ¬ . That is why ASCII cannot budge.

ECMA/TC1/72/25

E C M A
EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

THREE PROPOSALS ABOUT CODE HARMONIZATION

BY Mr. J. DUBOS, CII

MAY 1972

1 - EXCLAMATION MARK PUNCHED 11-8-2

It is recognized that a current practice is to represent on punched card the exclamation mark by holes 11-8-2, corresponding to table position 5/13 in the 7-bit code. But this practice is in contradiction with the 7-bit code since in this code the exclamation mark is in position 2/1, and must be represented on punched card by holes 12-8-7.

In view of code harmonization, it is strongly recommended to change this practice as soon as possible and to use another graphical character than exclamation mark in table position 5/13 of the 7-bit code. Exclamation mark should no more be punched 11-8-2 on punched card.

2 - LOGICAL NOT AND OVERLINE

It is recognized that a current practice is to interpret the circumflex accent (and the corresponding binary and punched codes) as a LOGICAL NOT and to stylise its graphical representation as follows :

¬

WMAH
311/1

To avoid a possible confusion with LOGICAL NOT, the OVERLINE must not be stylised with a similar shape, i.e as follows :

¬

The OVERLINE must be either straight on, or represented as a tilde.

3 - LOGICAL OR AND VERTICAL LINE

It is recognized that a current practice is to interpret the exclamation mark (position 2/1 of the 7-bit code table represented by holes 12-8-7 on punched card) as a LOGICAL OR and to stylise its graphical representation as follows :

|

When this representation is used for position 2/1 of the 7-bit code table, it is recommended not to use a VERTICAL LINE in another position (7/12 for example) or, if a VERTICAL LINE is needed, to print this character as a broken vertical line :

¦

ECMA/TC1/72/26

E C M A

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

CODE HARMONIZATION

Remarks to TC1/72/25

by Mr. Hekimi - May 1972

To item 1 : EXCLAMATION MARK

Mr. Dubos' proposal amounts to forbidding the use of 11-8-2 for the representation of EXCLAMATION MARK. This is completely in agreement with Standard ECMA-20 or ISO/R 1679. This is also in conformity with ECMA-6 or ISO/R 646 which forbids coding of a character already definitively allocated to a fixed code position (2/1) in another code position (5/13).

As to the graphic which should be allocated to 11-8-2, it must be that of 5/13. We have to distinguish two cases:

i) Any version - but the International Version:
All freedom should exist for the allocation of a character to this position, BUT to allocate a character already allocated elsewhere.

ii) International Version:
Hole-pattern 11-8-2 should be used to represent RIGHT SQUARE BRACKET.

To item 2: LOGICAL NOT

The official character in pos. 5/14 is ARROW HEAD and it should always be called with name and shown as an arrow head and not as ¬.

In any given application, the user is, of course, free to use this character with a meaning which he intends to attribute to it. This, too, is in conformity with ECMA-6 or ISO/R 646 as the exact meaning of the characters is not really prescribed. Obviously, it is allowable to use ARROW HEAD with the meaning of LOGICAL NOT. But this is a typical case of hardware representation of a character not existing in the 7-bit coded character set - and not a case of substitution.

Whether, as a consequence of this customary use of ARROW HEAD, the graphical shape of OVERLINE should be

~ rather than ‾

and/or should be called TILDE remains to be decided.

NMAH 311/1

To item 3 : LOGICAL OR

We have here a similar situation, but with a different conclusion. Again: EXCLAMATION MARK can be used as hardware representation of LOGICAL OR, as this character does not exist in the 7-bit coded character set. Nevertheless, it should normally be represented by its usual graphism:

!

This is the basic philosophy of the 7-bit code. The proposal to represent it by:

|

amounts practically to propose a change of character allocation for position 2/1. This cannot be agreed upon. The suggested consequence, namely to represent VERTICAL LINE by

¦

even less, because this would mean complete endorsement of the first proposal.

Summary

When considering code harmonization we have to be very careful about the different topics we are speaking of. I suggest to make the following distinctions :

i) The 7-bit coded character set is definitively established, it cannot and should not be modified.

ii) If this character set is used, and if characters not present in it have to be represented, a hardware representation is always possible. Hardware representation means to use an existing character (as it is) to represent another character outside the set. But if the shape of that other character is used, this is no more a hardware representation but a substitution.

iii) If a character set is needed for a given application, which shows :

| in 2/1
¬ in 5/13
¦ in 7/14

it is a non-compatible variant of the 7-bit code (see ECMA-35, note of paragraph 4.1). It can be generated by extension technique using ESC 2/5 (F) with a final from column 5. Reason for this clarification is that the character VERTICAL LINE has been moved from 7/14 to 2/1 which is forbidden.

iv) Code harmonization is a much more restricted topic related

a) to punched card coding only,

b) to few positions for which there is sometimes a de facto use in contradiction with the 7-bit code recommended use,

c) to find ad hoc solution for these particular problems.

In making a clean separation between :

- 7-bit coded character set
- Hardware representation
- Substitution
- Code extension
- Code harmonization

our discussions should become easier or at least clearer.

american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

secretariat: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466-2288

Doc. No. X3L2/1235
Date May 24, 1972
Project 12

COMMITTEE CORRESPONDENCE

Reply to: J. B. BOOTH
Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

MR. ROBERT M. BROWN
Director of Standards
BEMA
1828 L Street, N. W.
Washington, D. C. 20036

Dear Bob:

Subject: Revision of ISO/R 646; Reference my Letter of April 17, 1972

I have reviewed the Draft International Standard ISO/DIS 646 and have found the document to be in conformance with 97/2 N 566.

There are some very minor editorial changes which do not change the substance of the document. There are, however, a number of editorial corrections which should be made; these are detailed in the attachment which should accompany the USA affirmative response to the letter ballot on ISO/DIS 646.

Sincerely,

JBBooth

J. B. BOOTH
X3L2 International Representative

JBB:sb

Enclosure

Copy to:
Mr. D. W. Smith
X3L2 Members and Alternates

NMAH 311/2

EDITORIAL CORRECTIONS TO
DRAFT INTERNATIONAL STANDARD ISO/DIS 646

1. Table 1 - Basic Code Table
   a. Graphical representation of - (hyphen), position 2/13, should be shortened.
   b. The : (colon) and ; (semicolon) should be centered in positions 3/10 and 3/11 respectively.

2. Section 4.1, Control Characters
   Change the reference for Space from 6.2 to 7.2.

3. Section 4.2, Graphic Characters
   The graphic for ^ (upward arrow head) should be enlarged.

4. Section 6.2, International Reference Version - Table 1
   The graphic representation for the { (left curly bracket) should be placed in line with the other graphics.

5. Section 6.2, International Reference Version - Table 2
   The graphics " (quotation mark) - position 2/2, : (colon) - position 3/10, ; (semicolon) - position 3/11, ^ (upward arrow head) - position 5/14, and ‾ (overline) - position 7/14 should be centered in their respective character positions.

6. Section 7, Functional Characteristics Related to Control Characters
   The last two words in the opening paragraph of this section should be changed from "International Standards" to "ISO Publications."

7. Section 7.2, Specific Control Characters
   The word "or" in the last line of the definition for NUL should be changed to "and/or"; this is consistent with the definition for DEL.

DRAFT INTERNATIONAL STANDARD ISO/DIS 646

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION·ORGANISATION INTERNATIONALE DE NORMALISATION·МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

This Draft International Standard was submitted to Member Bodies on 28 April 1972

Voting on this Draft International Standard will terminate on 28 August 1972

7-BIT CODED CHARACTER SET FOR INFORMATION PROCESSING INTERCHANGE

(Revision of ISO/R 646-1967)

UDC 681.3.042 : 003.62

ISO/TC 97
Secretariat U.S.A.

DRAFT INTERNATIONAL STANDARD ISO/DIS 646

7-BIT CODED CHARACTER SET FOR INFORMATION PROCESSING INTERCHANGE

(Revision of ISO/R 646-1967)

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard contains a set of 128 characters (control characters and graphic characters such as letters, numerals and symbols) with their coded representation. Most of these characters are mandatory and unchangeable, but provision is made for some flexibility to accommodate special national and other requirements.

1.2 The need for graphics and controls in data processing and in data transmission has been taken into account in determining this character set.

1.3 This International Standard consists of a general table with a number of options, notes, a legend and explanatory notes. It also contains a specific international reference version, guidance on the exercise of the options to define specific national versions and application oriented versions.

1.4 This character set is primarily intended for the interchange of information among data processing systems and associated equipment.

1.5 This character set is applicable to all latin alphabets.

1.6 This character set includes facilities for extension where its 128 characters are insufficient for particular applications.

1.7 The definitions of some control characters in this International Standard assume that data associated with them is to be processed serially in a forward direction. Their effect when included in strings of data which are processed other than serially in a forward direction or included in data formatted for fixed record processing may have undesirable effects or may require additional special treatment to ensure that the control characters have their desired effect.

2 IMPLEMENTATION

2.1 This character set should be regarded as a basic alphabet in an abstract sense. Its practical use requires definitions of its implementation in various media. For example, this could include punched tapes, punched cards, magnetic tapes and transmission channels, thus permitting interchange of data to take place either indirectly by means of an intermediate recording in a physical medium, or by local electrical connection of various units (such as input and output devices and computers) or by means of data transmission equipment.

2.2 The implementation of this coded character set in physical media and for transmission, taking into account the need for error checking, is the subject of other ISO publications. (See Appendix X.)

3 BASIC CODE TABLE

TABLE 1 – Basic code table

b7						0	0	0	0	1	1	1	1
b6						0	0	1	1	0	0	1	1
b5						0	1	0	1	0	1	0	1
Bits	b4	b3	b2	b1	Column Row	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	TC_7 (DLE)	SP	0	③	P	` ④	p
	0	0	0	1	1	TC_1 (SOH)	DC_1	!	1	A	Q	a	q
	0	0	1	0	2	TC_2 (STX)	DC_2	" ⑥	2	B	R	b	r
	0	0	1	1	3	TC_3 (ETX)	DC_3	② £ (#)	3	C	S	c	s
	0	1	0	0	4	TC_4 (EOT)	DC_4	② $ (¤)	4	D	T	d	t
	0	1	0	1	5	TC_5 (ENQ)	TC_8 (NAK)	%	5	E	U	e	u
	0	1	1	0	6	TC_6 (ACK)	TC_9 (SYN)	&	6	F	V	f	v
	0	1	1	1	7	BEL	TC_{10} (ETB)	' ⑥	7	G	W	g	w
	1	0	0	0	8	FE_0 (BS)	CAN	(	8	H	X	h	x
	1	0	0	1	9	FE_1 (HT)	EM	)	9	I	Y	i	y
	1	0	1	0	10	FE_2 (LF) ①	SUB	*	:	J	Z	j	z
	1	0	1	1	11	FE_3 (VT) ①	ESC	+	;	K	③	k	③
	1	1	0	0	12	FE_4 (FF) ①	IS_4 (FS)	, ⑥	<	L	③	l	③
	1	1	0	1	13	FE_5 (CR) ①	IS_3 (GS)	—	=	M	③	m	③
	1	1	1	0	14	SO	IS_2 (RS)	.	>	N	^ ③ ⑥	n	— ④ ⑤
	1	1	1	1	15	SI	IS_1 (US)	/	?	O	_	o	DEL

NOTES ABOUT TABLE 1

① The format effectors are intended for equipment in which horizontal and vertical movements are effected separately. If equipment requires the action of CARRIAGE RETURN to be combined with a vertical movement, the format effector for that vertical movement may be used to effect the combined movement. For example, if NEW LINE (CR + LF) is required, FE_2 shall be used to represent it. This substitution requires agreement between the sender and the recipient of the data.

The use of these combined functions may be restricted for international transmission on general switched telecommunication networks (telegraph and telephone networks).

② The symbol £ is assigned to position 2/3 and the symbol $ is assigned to position 2/4. In a situation where there is no requirement for the symbol £ the symbol # (number sign) may be used in position 2/3. Where there is no requirement for the symbol $ the symbol ¤ (currency sign) may be used in position 2/4. The chosen allocations of symbols to these positions for international information interchange shall be agreed between the interested parties. It should be noted that, unless otherwise agreed between sender and recipient, the symbols £, $ or ¤ do not designate the currency of a specific country.

③ National use positions. The allocations of characters to these positions lies within the responsibility of national standardization bodies. These positions are primarily intended for alphabet extensions. If they are not required for that purpose, they may be used for symbols.

④ Positions 5/14, 6/0 and 7/14 are provided for the symbols UPWARD ARROW HEAD, GRAVE ACCENT and OVERLINE. However, these positions may be used for other graphical characters when it is necessary to have 8, 9 or 10 positions for national use.

⑤ Position 7/14 is used for the graphic character ‾ (OVERLINE), the graphical representation of which may vary according to national use to represent ~ (TILDE) or another diacritical sign provided that there is no risk of confusion with another graphic character included in the table.

⑥ The graphic characters in positions 2/2, 2/7, 2/12 and 5/14 have respectively the significance of QUOTATION MARK, APOSTROPHE, COMMA and UPWARD ARROW HEAD; however, these characters take on the significance of the diacritical signs DIAERESIS, ACUTE ACCENT, CEDILLA and CIRCUMFLEX ACCENT when they are preceded or followed by the BACKSPACE character (0/8).

LEGEND

4.1 Control characters

Abbreviation	Note	Meaning	Position in the code table
ACK		Acknowledge	0/6
BEL		Bell	0/7
BS		Backspace	0/8
CAN		Cancel	1/8
CR	1	Carriage Return	0/13
DC		Device control	—
DEL		Delete	7/15
DLE		Data Link Escape	1/0
EM		End of Medium	1/9
ENQ		Enquiry	0/5
EOT		End of Transmission	0/4
ESC		Escape	1/11
ETB		End of Transmission Block	1/7
ETX		End of Text	0/3
FE		Format Effector	—
FF	1	Form Feed	0/12
FS		File Separator	1/12
GS		Group Separator	1/13
HT		Horizontal Tabulation	0/9
IS		Information Separator	—
LF	1	Line Feed	0/10
NAK		Negative Acknowledge	1/5
NUL		Null	0/0
RS		Record Separator	1/14
SI		Shift-In	0/15
SO		Shift-Out	0/14
SOH		Start of Heading	0/1
SP		Space (see 6.2)	2/0
STX		Start of Text	0/2
SUB		Substitute Character	1/10
SYN		Synchronous Idle	1/6
TC		Transmission Control	—
US		Unit Separator	1/15
VT	1	Vertical Tabulation	0/11

4.2 Graphic characters

Graphic	Note	Name	Position in the code table
(space)		A normally non-printing graphic character (see 7.2)	2/0
!		Exclamation mark	2/1
"	6	Quotation mark, Diaeresis	2/2
£	2	Pound sign	2/3
#	2	Number sign	2/3
$	2	Dollar sign	2/4
¤	2	Currency sign	2/4
%		Percent sign	2/5
&		Ampersand	2/6
'	6	Apostrophe, acute accent	2/7
(		Left parenthesis	2/8
)		Right parenthesis	2/9
*		Asterisk	2/10
+		Plus sign	2/11
,	6	Comma, Cedilla	2/12
-		Hyphen, Minus sign	2/13
.		Full stop (period)	2/14
/		Solidus	2/15
:		Colon	3/10
;		Semi-colon	3/11
<		Less than sign	3/12
=		Equals sign	3/13
>		Greater than sign	3/14
?		Question mark	3/15
^	4, 6	Upward arrow head, Circumflex accent	5/14
_		Underline	5/15
`	4	Grave accent	6/0
‾	4, 5	Overline, Tilde	7/14

EXPLANATORY NOTES

5.1 Numbering of the positions in Table 1

Within any one character the bits are identified by $b_7, b_6 \ldots b_1$, where b_7 is the highest order, or most significant bit, and b s the lowest order, or least significant bit.

If desired, these may be given a numerical significance in the binary system, thus :

Bit identification :	b_7	b_6	b_5	b_4	b_3	b_2	b_1
Significance :	64	32	16	8	4	2	1

In the table the columns and rows are identified by numbers written in binary and decimal notations.

Any one position in the table may be identified either by its bit pattern, or by its column and row numbers. For instance, the position containing the numeral 1 may be identified :

- by its bit pattern, i.e. 011 0001;
- by its column and row numbers, i.e. 3/1.

The column number is derived from bits b_7, b_6 and b_5 giving them weights of 4, 2 and 1 respectively. The row number is derived from bits b_4, b_3, b_2 and b_1 giving them weights of 8, 4, 2 and 1 respectively.

5.2 Diacritical signs

In the 7-bit character set, some printing symbols may be designed to permit their use for the composition of accented letters when necessary for general interchange of information. A sequence of three characters, comprising a letter, "backspace" and one of these symbols, is needed for this composition; the symbol is then regarded as a diacritical sign. It should be noted that ese symbols take on their diacritical significance when they are preceded or followed by one "backspace" character; for ample, the symbol corresponding to the code combination 2/7 normally has the significance of "apostrophe", but becomes the diacritical sign "acute accent" when it precedes or follows a "backspace" character.

order to increase efficiency, it is possible to introduce accented letters (as single characters) in the positions marked by note ③ in the code table. According to national requirements, these positions may contain special diacritical signs.

3 Names, meanings and fonts of graphic characters

This International Standard assigns at least one name to denote each of the graphic characters displayed in Tables 1 and 2. The names chosen to denote graphic characters are intended to reflect their customary meanings. However, this International tandard does not define and does not restrict the meanings of graphic characters. In addition, it does not specify a particular style or font design for the graphic characters.

Under the provision of Note ③ of Table 1, graphic characters which are different from the characters of the international eference version may be assigned to the national use positions. When such assignments are made, the graphic characters shall have distinct forms and be given distinctive names which are not in conflict with any of the forms or the names of any of the graphic characters in the international reference version.

5.4 Uniqueness of character allocation

A character allocated to a position in Table 1 may not be placed elsewhere in the table. For example, in the case of position 2/3 the character not used cannot be placed elsewhere. In particular the POUND sign (£) can never be represented by the bit combination of position 2/4.

6 VERSIONS OF TABLE 1

6.1 General

6.1.1 In order to use Table 1 for information interchange, it is necessary to exercise the options left open, i.e. those affected by Notes ② to ⑤ . A single character must be allocated to each of the positions for which this freedom exists or it must be declared to be unused. A code table completed in this way is called a "version".

6.1.2 The notes to Table 1, the explanatory notes and the legend apply in full to any version.

6.2 International reference version

This version is available for use when there is no requirement to use a national or an application-oriented version. In international information processing interchange the international reference version (Table 2) is assumed unless a particular agreement exists between sender and recipient of the data. The following characters are allocated to the optional positions of Table 1 :

#	Number sign	2/3
¤	Currency sign	2/4
@	Commercial at	4/0
[	Left square bracket	5/11
\	Reverse solidus	5/12
]	Right square bracket	5/13
{	Left curly bracket	7/11
|	Vertical line	7/12
}	Right curly bracket	7/13

It should be noted that no substitution is allowed when using the international reference version.

TABLE 2 – International reference version

Bits				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1	Column / Row	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	TC$_7$ (DLE)	SP	0	@	P	`	p
0	0	0	1	1	TC$_1$ (SOH)	DC$_1$	!	1	A	Q	a	q
0	0	1	0	2	TC$_2$ (STX)	DC$_2$	"	2	B	R	b	r
0	0	1	1	3	TC$_3$ (ETX)	DC$_3$	#	3	C	S	c	s
0	1	0	0	4	TC$_4$ (EOT)	DC$_4$	¤	4	D	T	d	t
0	1	0	1	5	TC$_5$ (ENQ)	TC$_8$ (NAK)	%	5	E	U	e	u
0	1	1	0	6	TC$_6$ (ACK)	TC$_9$ (SYN)	&	6	F	V	f	v
0	1	1	1	7	BEL	TC$_{10}$ (ETB)	'	7	G	W	g	w
1	0	0	0	8	FE$_0$ (BS)	CAN	(	8	H	X	h	x
1	0	0	1	9	FE$_1$ (HT)	EM	)	9	I	Y	i	y
1	0	1	0	10	FE$_2$ (LF)	SUB	*	:	J	Z	j	z
1	0	1	1	11	FE$_3$ (VT)	ESC	+	;	K	[	k	{
1	1	0	0	12	FE$_4$ (FF)	IS$_4$ (FS)	,	<	L	\	l	|
1	1	0	1	13	FE$_5$ (CR)	IS$_3$ (GS)	−	=	M	]	m	}
1	1	1	0	14	SO	IS$_2$ (RS)	.	>	N	^	n	‾
1	1	1	1	15	SI	IS$_1$ (US)	/	?	O	_	o	DEL

6.3 National versions

6.3.1 The responsibility for defining national versions lies with the national standardization bodies. These bodies shall exercise the options available and make the required selection.

6.3.2 If so required, more than one national version can be defined within a country. The different versions shall be separately identified. In particular when for a given national use position, for example, 5/12 or 6/0, alternative characters are required, two different versions shall be identified, even if they differ only by this single character.

6.3.3 If there is in a country no special demand for specific characters, it is strongly recommended that the characters of the international reference version be allocated to the same national use positions.

NOTE — Appendix Y shows, for information only, the allocation of characters to optional positions in different countries, so far they are known as per . . .,1972. However, it should be noted that the allocations appearing in the specifications of the official standards are the only valid ones.

6.4 Application-oriented versions

Within national or international industries, organizations or professional groups, application-oriented versions can be used. They require precise agreement among the interested parties, who will have to exercise the options available and to make the required selection.

7 FUNCTIONAL CHARACTERISTICS RELATED TO CONTROL CHARACTERS

Some definitions in this section are stated in general terms and more explicit definitions of use may be needed for specific implementation of the code table on recording media or on transmission channels. These more explicit definitions and the use of these characters are the subject of other International Standards.

7.1 General designations of control characters

The general designation of control characters involves a specific class name followed by a subscript number.

They are defined as follows :

TC Transmission control characters

Control characters intended to control or facilitate transmission of information over telecommunication networks.

The use of the TC characters on the general telecommunication networks is the subject of other ISO publications.

The transmission control characters are :

ACK, DLE, ENQ, EOT, ETB, ETX, NAK, SOH, STX and SYN.

FE Format effectors

Control characters mainly intended for the control of the layout and positioning of information on printing and/or display devices. In the definitions of specific format effectors, any reference to printing devices should be interpreted as including display devices.

The definitions of format effectors use the following concept :

a) a page is composed of a number of lines of characters;

b) the characters forming a line occupy a number of positions called character positions;

c) the active position is that character position in which the character about to be processed would appear, if it were to be printed. The active position normally advances one character position at a time.

The format effector characters are : BS, CR, FF, HT, LF and VT (see also Note ①).

Device control characters

Control characters for the control of a local or remote ancillary device (or devices) connected to a data processing and/or telecommunication system. These control characters are not intended to control telecommunication systems; this should be achieved by the use of TCs.

Certain preferred uses of the individual DCs are given in 7.2.

IS Information separators

Control characters that are used to separate and qualify data logically. There are four such characters. They may be used either in hierarchical order or non-hierarchically; in the latter case their specific meanings depend on their applications.

When they are used hierarchically, the ascending order is :

US, RS, GS, FS.

In this case, data normally delimited by a particular separator cannot be split by a higher order separator but will be considered as delimited by any higher order separator.

.2 Specific control characters

Individual members of the classes of controls are sometimes referred to by their abbreviated class name and a subscript number (for example, TC$_5$) and sometimes by a specific name indicative of their use (for example, ENQ).

ifferent but related meanings may be associated with some of the control characters but in an interchange of data this normally requires agreement between the sender and the recipient.

CK Acknowledge

A transmission control character transmitted by a receiver as an affirmative response to the sender.

EL Bell

A control character that is used when there is a need to call for attention; it may control alarm or attention devices.

Backspace

A format effector which moves the active position one character position backwards on the same line.

CAN Cancel

A character, or the first character of a sequence, indicating that the data preceding it is in error. As a result, this data is to be ignored. The specific meaning of this character must be defined for each application and/or between sender and recipient.

Carriage return

A format effector which moves the active position to the first character position on the same line.

vice controls

DC$_1$ A device control character which is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to restore a device to the basic mode of operation (see also DC$_2$ and DC$_3$), or for any other device control function not provided by other DCs.

DC_2 A device control character which is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to set a device to a special mode of operation (in which case DC_1 is used to restore the device to the basic mode), or for any other device control function not provided by other DCs.

DC_3 A device control character which is primarily intended for turning off or stopping an ancillary device. This function may be a secondary level stop, for example, wait, pause, stand-by or halt (in which case DC_1 is used to restore normal operation). If it is not required for this purpose, it may be used for any other device control function not provided by other DCs.

DC_4 A device control character which is primarily intended for turning off, stopping or interrupting an ancillary device. It it is not required for this purpose, it may be used for any other device control function not provided by other DCs.

Examples of use of the device controls :

1) One switching		
	on – DC_2	off – DC_4
2) Two independent switchings		
first one	on – DC_2	off – DC_4
second one	on – DC_1	off – DC_3
3) Two dependent switchings		
general	on – DC_2	off – DC_4
particular	on – DC_1	off – DC_3
4) Input and output switching		
output	on – DC_2	off – DC_4
input	on – DC_1	off – DC_3

DEL Delete

A character used primarily to erase or obliterate an erroneous or unwanted character in punched tape. DEL characters may also serve to accomplish media-fill or time-fill. They may be inserted into or removed from a stream of data without affecting the information content of that stream but then the addition or removal of these characters may affect the information layout and/or the control of equipment.

DLE Data link escape

A transmission control character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphic characters and transmission control characters can be used in DLE sequences.

EM End of medium

A control character that may be used to identify the physical end of a medium, or the end of the used portion of a medium, or the end of the wanted portion of data recorded on a medium. The position of this character does not necessarily correspond to the physical end of the medium.

ENQ Enquiry

A transmission control character used as a request for a response from a remote station – the response may include station identification and/or station status. When a "Who are you" function is required on the general switched transmission network, the first use of ENQ after the connection is established shall have the meaning "Who are you" (station identification). Subsequent use of ENQ may, or may not, include the function "Who are you", as determined by agreement.

EOT End of transmission

A transmission control character used to indicate the conclusion of the transmission of one or more texts.

ESC Escape

A control character which is used to provide additional control functions. It alters the meaning of a limited number of contiguously following bit combinations. The use of this character is specified in International Standard . . ..

ETB End of transmission block

A transmission control character used to indicate the end of a transmission block of data where data is divided into such blocks for transmission purposes.

ETX End of text

A transmission control character which terminates a text.

FF Form feed

A format effector which advances the active position to the same character position on a pre-determined line of the next form or page.

HT Horizontal tabulation

A format effector which advances the active position to the next pre-determined character position on the same line.

Information separators

IS_1 (US) A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a UNIT.

IS_2 (RS) A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a RECORD.

IS_3 (GS) A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a GROUP.

IS_4 (FS) A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a FILE.

LF Line feed

A format effector which advances the active position to the same character position of the next line.

NAK Negative acknowledge

A transmission control character transmitted by a receiver as a negative response to the sender.

NUL Null

A control character used to accomplish media-fill or time-fill. NUL characters may be inserted into or removed from a stream of data without affecting the information content of that stream; but then the addition or removal of these characters may affect the information layout or the control of equipment.

SI Shift-in

A control character which is used in conjunction with SHIFT-OUT to extend the graphic character set of the code. It reinstates the standard meanings of the bit combinations which follow it. The effect of this character when using code extension techniques is described in International Standard . . ..

SO Shift-out

A control character which is used in conjunction with SHIFT-IN to extend the graphic character set of the code. It alters the meaning of the bit combinations of columns 2 to 7 which follow it until a SHIFT-IN character is reached. However, the characters SPACE (2/0) and DELETE (7/15) are unaffected by SHIFT-OUT. The effect of this character when using code extension techniques is described in International Standard . . ..

SOH Start of heading

A transmission control character used as the first character of a heading of an information message.

SP Space

A character which advances the active position one character position on the same line.

This character is also regarded as a non-printing graphic.

STX Start of text

A transmission control character which precedes a text and which is used to terminate a heading.

SUB Substitute character

A control character used in the place of a character that has been found to be invalid or in error. SUB is intended to be introduced by automatic means.

SYN Synchronous idle

A transmission control character used by a synchronous transmission system in the absence of any other character (idle condition) to provide a signal from which synchronism may be achieved or retained between data terminal equipment.

VT Vertical tabulation

A format effector which advances the active position to the same character position on the next pre-determined line.

APPENDIX Y

TABLE OF OPTIONS

NOTE — The options given in the table are those known at . . . . 1972. However it should be noted that the allocations given in the official standards are the only valid ones.

COUNTRIES	POSITIONS (Column/row) IN THE 7 BIT CODE TABLE											
	2/3	2/4	4/0	5/11	5/12	5/13	5/14	6/0	7/11	7/12	7/13	7/14
AUSTRALIA X1 1969	#	$	@	[	\	]	^	`	{	¦	}	~
BELGIUM	#	$	@	[	\	]	^	`	{	|	}	‾
	#	$	à	°	ç	§	^	`	é	ĳ	è	‾
DENMARK DS 2089/1969				Æ	Ø	Å			œ	ø	å	
FINLAND				Ä	Ö	Å			ä	ö	å	
FRANCE	£	$	à	°	ç	§	^	`	é	ù	è	¨
	#	$	@	[	\	]	^	`	{	|	}	~
GERMANY DIN 66003/1968	#	$	@	[	\	]	^	`	{	|	}	‾
	£	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	β
HUNGARY MSZ 9212	#	Ft	§	É	Ö	Ü	Á	ó	é	ö	ü	á
ITALY	#	¤	@	[	\	]	^	`	{	|	}	‾
	£	$	§	°	ç	é	^	ù	à	ò	è	ì
JAPAN JIS C-6220/1969	#	$	@	[	¥	]	^	`	{	|	}	‾

COUNTRIES \ POSITIONS (Column/row) IN THE 7 BIT CODE TABLE	2/3	2/4	4/0	5/11	5/12	5/13	5/14	6/0	7/11	7/12	7/13	7/14
NETHERLANDS NEN 003 03500	£	$	@	[	\	]	^	`	{	|	}	~
					IJ					ij		
NORWAY				Æ	Ø	Å			œ	ø	å	
SPAIN					Ñ					ñ		
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	
SWITZERLAND	#	¤	@	[	\	]	^	`	{	|	}	~
				Ä	Ö	Ü			ä	ö	ü	β
			à		ç				é	ù	è	~
					ç	é		ù	à	ò	è	ì
UNITED KINGDOM BS 47 30 1971	£	$	@	[	\	]	↑	`	{	|	}	‾
					10							
					1/2							
U.S.A. X3.4/1968	#	$	@	[	\	]	^	`	{	¦	}	~
U.S.S.R. Gost 13052/1967	#	¤		[	∨	]	^	`				‾

APPENDIX Z

ISO Recommendation R 646-1967 contained a table for a 6-bit coded character set. This character set has been deleted from the present International Standard and is no more part of the Standard. The corresponding table with the relevant Notes is reproduced in this Appendix for information only.

							0	0	1	1
							0	1	0	1
Bits	b_6	b_5	b_4	b_3	b_2	b_1	Column Row	0	1	2	3
			0	0	0	0	0	SP	0	NUL	P
			0	0	0	1	1	F_1 (HT)	1	A	Q
			0	0	1	0	2	F_2 (LF) ①	2	B	R
			0	0	1	1	3	F_3 (VT)	3	C	S
			0	1	0	0	4	F_4 (FF)	4	D	T
			0	1	0	1	5	F_5 (CR) ①	5	E	U
			0	1	1	0	6	SO	6	F	V
			0	1	1	1	7	SI	7	G	W
			1	0	0	0	8	(	8	H	X
			1	0	0	1	9	)	9	I	Y
			1	0	1	0	10	*	: ⑧	J	Z
			1	0	1	1	11	+	; ⑧	K	([) ③
			1	1	0	0	12	,	< ⑨ $ ②	L	(£) ② ③
			1	1	0	1	13	—	= %	M	(]) ③
			1	1	1	0	14	.	> &	N	ESC
			1	1	1	1	15	/	'	O	DEL

① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.

For equipment which uses a single control for a combined carriage return and line feed operation,

- in the 6-bit set table, the function F_2 will have the meaning of "New Line" (NL). F_5 will then have the meaning of "Back-space" (BS);
- in the 7-bit set table, the function FE_2 will have the meaning of "New Line" (NL).

These substitutions require agreement between the sender and the recipient of the data.

The use of this function "NL" is not allowed for international transmission on general telecommunication networks (Telex and Telephone networks).

② For international information interchange, $ and £ symbols do not designate the currency of a given country. The use of these symbols combined with other graphic symbols to designate national currencies may be the subject of other ISO Recommendations.

③ Reserved for National Use. These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and a recommended choice is shown in parenthesis in some cases.

Some restrictions are placed on the use of these characters on the general telecommunication networks for international transmission.

⑧ If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi-colon" (;) respectively. These substitutions require agreement between the sender and the recipient of the data.

On the general telecommunication networks, the characters "colon" and "semi-colon" are the only ones authorized for international transmission.

⑨ Either of the two sets of three symbols shown in these positions in the table may be chosen; the interpretation of the corresponding combinations requires agreement between the sender and the recipient of the data.

February 1972

EXPLANATORY REPORT

of the ISO/TC 97 Secretariat (U.S.A.) concerning

draft International Standard ISO/DIS 646 - 7-bit coded character set for information processing interchange

proposed by Technical Committee ISO/TC 97 - Computers and information processing.

Definition of 6 and 7-bit coded character sets for information processing interchange was decided during the first meeting of Sub-committee ISO/TC 97/SC 2 "Character sets and coding" (May 1962).

In December 1967, the draft concerning the definition of these character sets was accepted by ISO Council as an ISO Recommendation.

During its London meeting (October 1970), Sub-committee ISO/TC 97/SC 2 decided to revise this Recommendation. A preparatory group was created for this purpose.

It was decided to delete the 6-bit code, to include an international reference version of the 7-bit code.

During its Tokyo meeting (October 1971) Sub-committee ISO/TC 97/SC 2 accepted a revised document (97/2 N 566) and approved the following Resolution:

Resolution no. 3 - Revision of ISO R 646

ISO/TC 97/SC 2 have adopted doc. 525 with a new clause 1.1.7.

The Secretariat of SC 2 is directed as follows:

i) to send the amended doc. 525 to the Secretariat of TC 97 for processing as a draft International Standard under accelerated procedures;

ii) to send a copy of the revised document before November 15, 1971 to CCITT for consideration by GM-ALP, and request comments;

iii) to circulate possible comments of GM-ALP on this document immediately after their April meeting;

iv) to contact the ISO Central Secretariat to ensure that the final letter ballot period is set for April 1 to September 30, 1972, and request it to mention in the cover ballot letter that comments by CCITT will follow, so that the Member Bodies can consider these comments before voting.

The attached document is therefore submitted for letter ballot to P-members of ISO/TC 97 and to all ISO Member Bodies.

TC 1 - 72/28A

Doc. No. X3L2/1237
Date May 26, 1972
Project 12

american national standards committees:
X3–Computers & Information Processing
X4–Office Machines & Supplies

COMMITTEE CORRESPONDENCE

: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466-2288

FROM: Eric H. Clamons - Chairman X3L2
TO: X3L2
CC: Mr. Ted Wiese SHARE/GUIDE/X3

Reply to: Eric H. Clamons
Honeywell Info. Sys., Inc.
200 Smith Street
Waltham, Mass. 02154
M.S. 453

SUBJECT: Revision of X3.4

At the next meeting we will start to edit the ANS X3.4 Revision.

YOU MUST SUBMIT WRITTEN CONTRIBUTIONS ON THIS SUBJECT TO ASSURE THAT YOUR INPUT IS CONSIDERED.

Based on the resolution passed at our last meeting these are the changes which will be made:

Section 2

Replace ¦ by |

Section 3

Cross out "or USASC11" and associated wording in last two paragraphs

Section 4.2

Replace ¦ by |
Delete note 4
Add note 3 to 2/4 $

Section 6.4

Replace last sentence by: The syntax of PL/1 associates the symbols of position 2/1 with logical OR and those of 5/14 with logical NOT. Users employing stylized substitutes for the symbols usually associated with these positions of the table are cautioned that they may run into ambiguities. (See Appendix A5.3 and A5.4.)

Section A5

Eliminate A5.3 and add new A5.3: The USA adopted the tilde (~) to represent the "Overline" character to avoid confusion with underline hyphen and logical NOT. In some countries and in ISO R646 this precaution is not used; i.e., the overline is shown as an elevated horizontal line. If in addition the circumflex (^) is stylized as a logical NOT, hand printed and machine printed data may be misinterpreted.

NMAH 311/1

Section A5.4

Add new A5.4: The vertical line conforms to ISO R646 and to other national practices. The stylization of exclamation point (!) to represent a logical OR may lead to misinterpretation.

Section B4

Delete last paragraph, change ¦ to | add: Except for the $ and ~ symbols the U.S. choice of characters is identical with the ISO version. In this revision the "broken vertical" line was replaced by the vertical line in the table because of international pressure and acceptance by the PL/1 committees that the exclamation point may be used to represent logical OR in PL/1 documentation.

E. H. Clamons

american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

Doc. No. X3L2/1237
Date May 26, 1972
Project 12

COMMITTEE CORRESPONDENCE

secretariat: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466-2288

FROM: Eric H. Clamons - Chairman X3L2
TO: X3L2
CC: Mr. Ted Wiese SHARE/GUIDE/X3
Tom Steel Jr

Reply to: Eric H. Clamons
Honeywell Info. Sys., Inc.
200 Smith Street
Waltham, Mass. 02154
M.S. 453

SUBJECT: Revision of X3.4

At the next meeting we will start to edit the ANS X3.4 Revision.

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Replace ¦ by |

Section 3

Cross out "or USASC11" and associated wording in last two paragraphs

Section 4.2

Replace ¦ by |
Delete note 4
Add note 3 to 2/4 $

Section 6.4

Replace last sentence by: The syntax of PL/1 associates the symbols of position 2/1 with logical OR and those of 5/14 with logical NOT. Users employing stylized substitutes for the symbols usually associated with these positions of the table are cautioned that they may run into ambiguities. (See Appendix A5.3 and A5.4.)

Section A5

Eliminate A5.3 and add new A5.3: The USA adopted the tilde (~) to represent the "Overline" character to avoid confusion with underline hyphen and logical NOT. In some countries and in ISO R646 this precaution is not used; i.e., the overline is shown as an elevated horizontal line. If in addition the circumflex (^) is stylized as a logical NOT, hand printed and machine printed data may be misinterpreted.

NMAH 311/3

Section A5.4

Add new A5.4: The vertical line conforms to ISO R646 and to other national practices. The stylization of exclamation point (!) to represent a logical OR may lead to misinterpretation.

Section B4

Delete last paragraph, change ¦ to | add: Except for the $ and ~ symbols the U.S. choice of characters is identical with the ISO version. In this revision the "broken vertical" line was replaced by the vertical line in the table because of international pressure and acceptance by the PL/1 committees that the exclamation point may be used to represent logical OR in PL/1 documentation.

E. H. Clamons

ansi american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

secretariat: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466-2288

Ref. Doc. No. X3L2/1237
Date 1972 June 16
Project 12

COMMITTEE CORRESPONDENCE

Reply to: H. F. Ickes
IBM Corporation
Dept. B18/Bldg. 707-2
P.O. Box 390
Poughkeepsie, New York
12602

RECEIVED
1972 JUN 26
ERIC H. CLAMONS

TO: X3L2 Members, Alternates and Consultants

SUBJECT: Revision of X3.4

The referenced document has as the opening statement of its technical part the following:

> "Based on the resolution passed at our last meeting these are the changes which will be made:"

I believe the above quotation to be in error. According to the draft minutes of our last meeting, Document X3L2/1213F, item 8.2 on page 6, the resolution that was passed on this subject read as follows:

> "That X3L2 act first upon the following items in the revision of X3.4-1968:
>
> 1. Vertical Line
> 2. Circumflex
> 3. The syntactic versus stylistic interpretations of ! and ^.
> 4. Definitions of controls attempting to clarify and bring into agreement with code extension requirements."

An analysis of the above resolution says simply that the situation concerning the Vertical Line, Circumflex and Exclamation point would be acted upon first. This could mean a thorough discussion of the situation but certainly did not mean that any changes at all would result.

NMAH 311/3

As for the changes, which I must classify as being "proposed by Eric Clamons", I offer the following comments:

> It was at the great insistance of the Programming Community that Logical OR | and Logical NOT ¬ were standardized as optional graphics for the Exclamation Point and Circumflex. respectively. As a result, these optional graphics have been implemented on printer and display products and are in widespread use. From discussions with some of its members, the Programming Community will be against any notion to remove the optional graphics from the standard. In addition, terminal manufacturers as well as printer and display manufacturers, will be against the change, because many of them have implemented them on their products.
>
> Also, it will be a mistake to replace ¦ by | because then if the | graphic appears, how will you know whether it means Logical Or or just a vertical line? If the retort is that one can tell by the context in which it is used, that same rational is true of its present position in the code. Why try to change it and thereby cause an even further confusing situation?
>
> I cannot accept compatibility with ISO R646 as a reason to change ASCII because ASCII is considered by many to be the US national variant of ISO R646 and the code positions under discussion are National Use positions to which graphic allocation is the responsibility of the National Standards Bodies.

Summary

Because of the widespread use of the optional graphics Logical OR and Logical NOT, I recommend that their present assignments in the code remain.

One of the best ways to discourage use of a code that I know of is to keep making changes to it.

H. F. Ickes
H. F. Ickes

HFI/jan

COMMITTEE CORRESPONDENCE

ansi american national standards committees:
X3—Computers & information Processing
X4—Office Machines & Supplies

secretariat: BEMA, 1828 L St., N.W., Washington, D.C. 20036 (202) 466—2288

Doc. No. X3L2/1269

Date October 2, 1972

Project 12

Reply to:
J. B. BOOTH
Teletype Corporation
5555 Touhy Avenue
Skokie, Illinois 60076

TO: X3L2 Members and Alternates

SUBJECT: Draft Proposed Revision of ASCII,
Reference H. F. Ickes' Document X3L2/1264 dated September 18, 1972

The following are proposed changes to the Draft Proposed Revision of ASCII (H. F. Ickes' document X3L2/1264):

1. Section 2, Standard Code table
    1.1 Change the control LF (Line Feed) in position 0/10 to NL (New Line).
    1.2 Change the control CR (Carriage Return) in position 0/13 to RT (Return).

2. Section 4, Legend
    2.1 Change LF Line Feed (FE) to NL New Line (FE).
    2.2 Change CR Carriage Return (FE) to RT Return (FE).

3. Section 5.2, Control Characters
    3.1 The definition for SOH (Start of Heading) should be:
    A communication control character used as the first character of a heading of an information message.
    NOTE: I assume that Mr. Ickes inadvertently omitted the phrase "of a heading."

    3.2 The definition for ETX should conform to DIS 646, viz: A communication control character which terminates a text.

    3.3 The character BS should be entitled "Backspace" or "Cursor Left."

    3.4 The definition for Line Feed should be revised as follows:
    NL (New Line): A format effector which advances the active position to the first character position on the next line. Where appropriate, this character may have the meaning "Line Feed" (LF), a format effector which advances the active position to the same character position of the next line. Use of this conversion requires agreement between sender and recipient of data.

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3.5 The definition for vertical tabulation should be changed to the following:

> A format effector which advances the active position to the first character position on the next pre-determined line.

3.6 The definition for Form Feed should be changed as follows:

> A format effector which advances the active position to the first character position on a pre-determined line on the next form or page.

3.7 The character CR (Carriage Return) should be changed to RT (Return).

3.8 The definition of SO (Shift-Out) and SI (Shift-In) should conform to DIS 646. To effect this change, the two words "and escape" in the second line of each definition should be removed and the word "may" in the third line of each definition should be removed.

Sincerely,

JB Booth

J. B. BOOTH
X3L2 Member

american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

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RECEIVED
1972 SEP 25
ERIC H. CLAMONS

Doc. No. X3L2/1264
Date 72/09/18
Project 12

COMMITTEE CORRESPONDENCE

Reply to: H. F. Ickes
IBM Corporation
Dept. B18/Bldg. 707-2
P.O. Box 390
Poughkeepsie, New York
12602

Memorandum To: X3L2 Members and Alternates

Subject: Draft Proposed Revision of ASCII
(X3.4-1968)

Attached is a draft proposed revision of ASCII (X3.4-1968). This is the result of an action at the last meeting which requested all members to submit revised definitions to me to be included in this draft. (Incidentally, I received none; therefore this represents my views on the subject.)

The changes were as follows:

1. Section 3 Removed the "USASCII" terminology. ✓

2. Section 5.2 Revised the definitions marked with a vertical line. Those definitions with just a vertical line were copied from DIS/646 dated 28 August 1972. Those definitions marked with a vertical line and an asterisk are my definitions because I felt that those available were not complete enough. ✓

3. Section 6 Deleted the old Section 6.3 which dealt with collating sequence. Collating sequence impacts internal computer design and, therefore, doesn't belong in ASCII which is a transmission code. NO

4. Section C1.1 Replaced the parenthesis notation which caused confusion, and added the missing Circumflex and Accent Grave characters. ✓

5. Appendix D Added the definition of "Active Position" which is more precise than "printing position". ✓

Hubert
H. F. Ickes

HFI/jan

8/113

1.14 MN

AMERICAN **Standard Code for Information Interchange**

1. Scope

This coded character set is to be used for the general interchange of information among information processing systems, communication systems, and associated equipment.

2. Standard Code

Bits b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → ROW ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	¦
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

3. Character Representation and Code Identification

The standard 7-bit character representation, with b_7 the high-order bit and b_1 the low-order bit, is shown below:

EXAMPLE: The bit representation for the character "K," positioned in column 4, row 11, is

b_7	b_6	b_5	b_4	b_3	b_2	b_1
1	0	0	1	0	1	1

The code table position for the character "K" may also be represented by the notation "column 4, row 11" or alternatively as "4/11." The decimal equivalent of the binary number formed by bits b_7, b_6, and b_5, collectively, forms the column number, and the decimal equivalent of the binary number formed by bits b_4, b_3, b_2, and b_1, collectively, forms the row number.

The standard code may be identified by the use of the notation ASCII.

The notation ASCII (pronounced as'-key) should ordinarily be taken to mean the code prescribed by the latest issue of the standard. To explicitly designate a particular (perhaps prior) issue, the last two digits of the year of issue may be appended, as, "ASCII 63" or " ASCII 68".

4. Legend

4.1 Control Characters

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell (audible or attention signal)
BS	Backspace (FE)
HT	Horizontal Tabulation (punched card skip) (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In

DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4 (Stop)
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete[1]

NOTE: (CC) Communication Control
(FE) Format Effector
(IS) Information Separator

[1] In the strict sense, DEL is not a control character. (See 5.2.)

4.2 Graphic Characters

Column/Row	Symbol	Name
2/0	SP	Space (Normally Non-Printing)
2/1	!	Exclamation Point
2/2	"	Quotation Marks (Diaeresis[2])
2/3	#	Number Sign[3,4]
2/4	$	Dollar Sign
2/5	%	Percent
2/6	&	Ampersand
2/7	'	Apostrophe (Closing Single Quotation Mark; Acute Accent[2])
2/8	(	Opening Parenthesis
2/9	)	Closing Parenthesis
2/10	*	Asterisk
2/11	+	Plus
2/12	,	Comma (Cedilla[2])
2/13	-	Hyphen (Minus)
2/14	.	Period (Decimal Point)
2/15	/	Slant
3/10	:	Colon
3/11	;	Semicolon
3/12	<	Less Than
3/13	=	Equals
3/14	>	Greater Than
3/15	?	Question Mark
4/0	@	Commercial At[3]
5/11	[	Opening Bracket[3]
5/12	\	Reverse Slant[3]
5/13	]	Closing Bracket[3]
5/14	^	Circumflex[2,3]
5/15	_	Underline
6/0	`	Grave Accent[2,3] (Opening Single Quotation Mark)
7/11	{	Opening Brace[3]
7/12	¦	Vertical Line[3]
7/13	}	Closing Brace[3]
7/14	~	Overline[3] (Tilde[2]; General Accent[2])

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[2] The use of the symbols in 2/2, 2/7, 2/12, 5/14, 6/0, and 7/14 as diacritical marks is described in Appendix A, A5.2.

[3] These characters should not be used in international interchange without determining that there is agreement between sender and recipient. (See Appendix B4.)

[4] In applications where there is no requirement for the symbol #, the symbol £ may be used in position 2/3.

5. Definitions

5.1 General

(CC) Communication Control: A functional character intended to control or facilitate transmission of information over communication networks.

(FE) Format Effector: A functional character which controls the layout or positioning of information in printing or display devices.

(IS) Information Separator: A character which is used to separate and qualify information in a logical sense. There is a group of four such characters, which are to be used in a hierarchical order.

5.2 Control Characters

NUL (Null): A control character used to accomplish media-fill or time fill. NUL characters may be inserted into or removed from a stream of data without affecting the information content of that stream; but then the addition or removal of these characters may affect the information layout or the control of equipment.

SOH (Start of Heading): A communication control character used as the first character of an information message.

STX (Start of Text): A communication control character which precedes a text and which is used to terminate a heading.

ETX (End of Text): A communication control character used to terminate a sequence of characters started with STX and transmitted as an entity.

EOT (End of Transmission): A communication control character used to indicate the conclusion of a transmission, which may have contained one or more texts and any associated headings.

ENQ (Enquiry): A communication control character used in data communication systems as a request for a response from a remote station. It may be used as a "Who Are You" (WRU) to obtain identification, or may be used to obtain station status, or both.

ACK (Acknowledge): A communication control character transmitted by a receiver as an affirmative response to a sender.

BEL (Bell): A character for use when there is a need to call for human attention. It may control alarm or attention devices.

BS (Backspace): A format effector which moves the active position one character position backwards on the same line.

HT (Horizontal Tabulation): A format effector which advances the active position to the next pre-determined character position on the same line.

*LF (Line Feed): A format effector which advances the active position to the same character position of the next line. Where appropriate, this character may have the meaning "New Line" (NL), a format effector which advances the active position to the first character position on the next line. Use of this convention requires agreement between sender and recipient of data.

VT (Vertical Tabulation): A format effector which advances the active position to the same character position on the next pre-determined line.

FF (Form Feed): A format effector which advances the active position to the same character position on a pre-determined line of the next form or page.

CR (Carriage Return): A format effector which moves the active position to the first character position on the same line.

*SO (Shift Out): A control character which is used in conjunction with Shift-In and Escape to extend the graphic character of the code. It may alter the meaning of the bit combinations of columns 2 to 7 which follow it until a Shift-In character is reached. However, the characters Space (2/0) and Delete (7/15) are unaffected by Shift-Out. The effect of this character when using code extension techniques is described in ANS ... .

*SI (Shift-In): A control character which is used in conjunction with Shift-Out and Escape to extend the graphic character set of the code. It may reinstate the standard meanings of the bit combinations which follow it. The effect of this character when using code extension techniques is described in ANS ... .

DLE (Data Link Escape): A communication control character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphic characters and transmission control characters can be used in DLE sequences.

DC1, DC2, DC3, DC4 (Device Controls): Characters for the control of ancillary devices associated with data processing or telecommunication systems, more especially switching devices "on" or "off". (If a single "stop" control is required to interrupt or turn off ancillary devices, DC4 is the preferred assignment.)

NAK (Negative Acknowledge): A communication control character transmitted by a receiver as a negative response to the sender.

SYN (Synchronous Idle): A communication control character used by a synchronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.

ETB (End of Transmission Block): A communication control character used to indicate the end of a block of data for communication purposes. ETB is used for blocking data where the block structure is not necessarily related to the processing format.

CAN (Cancel): A control character used to indicate that the data with which it is sent is in error or is to be disregarded. The specific meaning of this character must be defined for each application.

EM (End of Medium): A control character that may be used to identify the physical end of a medium, or the end of the used portion of a medium, or the end of the wanted portion of data recorded on a medium. (The position of this character does not necessarily correspond to the physical end of the medium.)

SUB (Substitute): A character that may be substituted for a character which is determined to be invalid or in error.

ESC (Escape): A control character intended to provide code extension (supplementary characters) in general information interchange. The Escape character itself is a prefix affecting the interpretation of a limited number of contiguously following characters. The effect of this character when using code extension techniques is described in ANS ... .

FS (File Separator), GS (Group Separator), RS (Record Separator), and US (Unit Separator): These information separators may be used within data in optional fashion, except that their hierarchical relationship shall be: FS in the most inclusive, then GS, then RS, and US in least inclusive. (The content and length of a File, Group, Record, or Unit are not specified.)

DEL (Delete): A character used primarily to erase or obliterate an erroneous or unwanted character in punched tape. DEL characters may also serve to accomplish media-fill or time-fill. They may be inserted into or removed from a stream of data without affecting the information content of that stream but then the addition or removal of these characters may affect the information layout and/or the control of equipment.

5.3 Graphic Characters

SP (Space): A character which advances the active position one character position on the same line.

This character is also regarded as a non-printing graphic.

6. GENERAL CONSIDERATIONS

6.1 This standard does not define the means by which the coded set is to be recorded in any physical medium, nor does it include any redundancy or define techniques for error control. Further, this standard does not define data communication character structure, data communication formats, code extension techniques, or graphic representation of control characters.

6.2 Deviations from the standard may create serious difficulties in information interchange and should be used only with full cognizance of the parties involved.

6.3 No specific meaning is prescribed for any of the graphics in the code table except that which is understood by the users. Furthermore, this standard does not specify a type style for the printing or display of the various graphic characters. In specific applications, it may be desirable to employ distinctive styling of individual graphics to facilitate their use for specific purposes as, for example, to stylize the graphics in code positions 2/1 and 5/14 into those frequently associated with logical OR (|) and logical NOT (¬), respectively.

6.4 The appendixes to this standard contain additional information on the design and use of this code.

american national standards committees:
X3—Computers & Information Processing
X4—Office Machines & Supplies

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Ref. Doc. No. X3L2/1278
Date 72/10/20
Project 12

COMMITTEE CORRESPONDENCE

RECEIVED
1972 OCT 26
ERIC H. CLAMONS

Reply to: H. F. Ickes
IBM Corporation
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PO Box 390
Poughkeepsie, New York
12602

Memorandum To: X3L2 Members and Alternates

Subject: Proposed Revision of ASCII

Attached is a proposed revision of ASCII that reflects the changes agreed upon at the X3L2 meeting in Cleveland. It was also agreed to circulate this proposed revision within X3L2 for ballot.

The sections changed are marked in the margin and the major ones are as follows:

1. The primary use of position 0/10 is to be New Line and the secondary use is to be Line Feed. The mnemonic is to be NL.
2. Carriage Return was changed to Return. mnemonic RT
3. The graphic for Vertical line (position 7/12) was changed from a broken vertical line (¦) to a solid vertical line (|).
4. The example of the stylization of the Exclamation Point and Circumflex as the Logical OR and Logical NOT were moved from the body of the standard (section 6.4) and placed in the appendix (section A5.8).
5. An option on the Vertical Tab control to advance the active position to the first character position.
6. Form Feed now moves the active position to the first character position on a pre-determined line of the next form or page.

8/113
HAMU

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7. Changed section 6.3 to state that if there is no application dependent requirement for a collating sequence, then the default collating sequence is defined by the binary values of the bit patterns.

Hubert
H. F. Ickes

HFI/jan

X3L2/1278
(X3L2/1264 revised)

DRAFT PROPOSED REVISION
AMERICAN STANDARD CODE
FOR
INFORMATION INTERCHANGE

proposed by: H.F. Ickes
Project 12 Leader

AMERICAN NATIONAL **Standard Code for Information Interchange**

1. Scope

This coded character set is to be used for the general interchange of information among information processing systems, communication systems, and associated equipment.

2. Standard Code

Bits b7 b6 b5					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4	b3	b2	b1	COLUMN / ROW	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	NL	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	RT	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

3. Character Representation and Code Identification

The standard 7-bit character representation, with b_7 the high-order bit and b_1 the low-order bit, is shown below:

EXAMPLE: The bit representation for the character "K," positioned in column 4, row 11, is

b_7	b_6	b_5	b_4	b_3	b_2	b_1
1	0	0	1	0	1	1

The code table position for the character "K" may also be represented by the notation "column 4, row 11" or alternatively as "4/11." The decimal equivalent of the binary number formed by bits b_7, b_6, and b_5, collectively, forms the column number, and the decimal equivalent of the binary number formed by bits b_4, b_3, b_2, and b_1, collectively, forms the row number.

The standard code may be identified by the use of the notation ASCII.

The notation ASCII (pronounced as'-key) should ordinarily be taken to mean the code prescribed by the latest issue of the standard. To explicitly designate a particular (perhaps prior) issue, the last two digits of the year of issue may be appended, as, "ASCII 63" or " ASCII 68".

4. Legend

4.1 Control Characters

Col/Row		
0/0	NUL	Null
0/1	SOH	Start of Heading (CC)
0/2	STX	Start of Text (CC)
0/3	ETX	End of Text (CC)
0/4	EOT	End of Transmission (CC)
0/5	ENQ	Enquiry (CC)
0/6	ACK	Acknowledge (CC)
0/7	BEL	Bell
0/8	BS	Backspace (FE)
0/9	HT	Horizontal Tabulation (FE)
0/10	NL	New Line (FE)
0/11	VT	Vertical Tabulation (FE)
0/12	FF	Form Feed (FE)
0/13	RT	Return (FE)
0/14	SO	Shift Out
0/15	SI	Shift In
1/0	DLE	Data Link Escape (CC)
1/1	DC1	Device Control 1
1/2	DC2	Device Control 2
1/3	DC3	Device Control 3
1/4	DC4	Device Control 4
1/5	NAK	Negative Acknowledge (CC)
1/6	SYN	Synchronous Idle (CC)
1/7	ETB	End of Transmission Block (CC)
1/8	CAN	Cancel
1/9	EM	End of Medium
1/10	SUB	Substitute
1/11	ESC	Escape
1/12	FS	File Separator (IS)
1/13	GS	Group Separator (IS)
1/14	RS	Record Separator (IS)
1/15	US	Unit Separator (IS)
7/15	DEL	Delete

NOTE: (CC) Communication Control
(FE) Format Effector
(IS) Information Separator

4.2 Graphic Characters

Column/Row	Symbol	Name
2/0	SP	Space (Normally Non-Printing)
2/1	!	Exclamation Point
2/2	"	Quotation Marks (Diaeresis[2])
2/3	#	Number Sign[3,4]
2/4	$	Dollar Sign
2/5	%	Percent Sign
2/6	&	Ampersand
2/7	'	Apostrophe (Closing Single Quotation Mark; Acute Accent[2])
2/8	(	Opening Parenthesis
2/9	)	Closing Parenthesis
2/10	*	Asterisk
2/11	+	Plus
2/12	,	Comma (Cedilla[2])
2/13	-	Hyphen (Minus)
2/14	.	Period (Decimal Point)
2/15	/	Slant
3/0 to 3/9		Digits 0 to 9 inclusive
3/10	:	Colon
3/11	;	Semicolon
3/12	<	Less Than
3/13	=	Equals
3/14	>	Greater Than
3/15	?	Question Mark
4/0	@	Commercial At[3]
4/0 to 5/10		Uppercase Latin letters A to Z inclusive
5/11	[	Opening Bracket[3]
5/12	\	Reverse Slant[3]
5/13	]	Closing Bracket[3]
5/14	^	Circumflex[2,3]
5/15	_	Underline
6/0	`	Opening Single Quotation Mark (Grave Accent[2,3])
6/1 to 7/10		Lower case Latin letters a to z inclusive
7/11	{	Opening Brace[3]
7/12	|	Vertical Line[3]
7/13	}	Closing Brace[3]
7/14	~	Tilde[2] (Overline[3])

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[2] The use of the symbols in 2/2, 2/7, 2/12, 5/14, 6/0, and 7/14 as diacritical marks is described in Appendix A, A5.2.

[3] These characters should not be used in international interchange without determining that there is agreement between sender and recipient. (See Appendix B4.)

5. DEFINITIONS

5.1 General

Control Character: A character whose occurrence in a particular content initiates, modifies, or stops an action that affects the recording, processing, transmission or interpretation of data.

Graphic Character: A character, other than a control character, that has a visual representation normally handwritten, printed or displayed.

(CC) Communication Control: A functional character intended to control or facilitate transmission of information over communication networks.

(FE) Format Effector: A functional character that controls the layout or positioning of information in printing or display devices.

(IS) Information Separator: A character that is used to separate and qualify information in a logical sense. There is a group of four such characters, which are to be used in a hierarchical order.

5.2 Control Characters

0/0 NUL (Null): A control character used to accomplish media-fill or time fill. NUL characters may be inserted into or removed from a stream of data without affecting the information content of that stream; but then the addition or removal of these characters may affect the information layout or the control of equipment.

0/1 SOH (Start of Heading): A communication control character used as the first character of a heading of an information message.

0/2 STX (Start of Text): A communication control character that precedes a text and which is used to terminate a heading.

0/3 ETX (End of Text): A communication control character that terminates a text.

0/4 EOT (End of Transmission): A communication control character used to indicate the conclusion of a transmission, which may have contained one or more texts and any associated headings.

0/5 ENQ (Enquiry): A communication control character used in data communication systems as a request for a response from a remote station. It may be used as a "Who Are You" (WRU) to obtain identification, or may be used to obtain station status, or both.

0/6 ACK (Acknowledge): A communication control character transmitted by a receiver as an affirmative response to a sender.

0/7 BEL (Bell): A control character for use when there is a need to call for attention. It may control alarm or attention devices.

(Backspace): A format effector that moves the active position character position backwards on the same line.

HT (Horizontal Tabulation): A format effector that advances the active position to the next predetermined character position on the same line.

/10 NL (New Line): A format effector which advances the active position to the first active position on the next line. Where appropriate, this character may have the meaning "Line Feed" (LF), a format effector which advances the active position to the same character position of the next line. Use of the LF convention requires agreement between sender and recipient of data.

0/11 VT (Vertical Tabulation): A format effector that advances the active position to the same character position on the next predetermined line. When agreed upon between the interchange parties, VT may advance the active position to the first character position on the next predetermined line.

0/12 FF (Form Feed): A format effector that advances the active position to the first character position on a predetermined line of the next form or page.

0/13 RT (Return): A format effector that moves the active position to the first character position on the same line.

0/14 SO (Shift Out): A control character that is used in conjunction with Shift In to extend the graphic character set. It may alter the meaning of the bit combinations of columns 2 to 7 which follow it until a Shift-In character is reached. However, the characters Space (2/0) and Delete (7/15) are unaffected. The effect of this character is described in the code extension standard (see section 7.0).

0/15 SI (Shift In): A control character that is used in conjunction with Shift Out and Escape to extend the graphic character set. It may reinstate the standard meanings of the bit combinations which follow it. The effect of this character is described in the code extension standard. (see section 7.0).

1/0 DLE (Data Link Escape): A communication control character that will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphic characters and transmission control characters can be used in DLE sequences.

1/1 DC1, DC2, DC3, DC4 (Device Controls): Control characters for the control of ancillary devices associated with data processing or telecommunication systems, more especially switching devices "on" or "off". (If a single "stop" control is required to interrupt or turn off ancillary devices, DC4 is the preferred assignment.)

NAK (Negative Acknowledge): A communication control character transmitted by a receiver as a negative response to the sender.

1/6 SYN (Synchronous Idle): A communication control character used by a synchronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.

1/7 ETB (End of Transmission Block): A communication control character used to indicate the end of a block of data for communication purposes. ETB is used for blocking data where the block structure is not necessarily related to the processing format.

1/8 CAN (Cancel): A control character used to indicate that the data with which it is sent is in error or is to be disregarded. The specific meaning of this character must be defined for each application.

1/9 EM (End of Medium): A control character that may be used to identify the physical end of a medium, or the end of the used portion of a medium, or the end of the wanted portion of data recorded on a medium. (The position of this character does not necessarily correspond to the physical end of the medium.)

1/10 SUB (Substitute): A character that may be substituted for a character which is determined to be invalid or in error.

1/11 ESC (Escape): A control character intended to provide code extension (supplementary characters) in general information interchange. The Escape character itself is a prefix affecting the interpretation of a limited number of contiguously following characters. The effect of this character is described in the code extension standard (see section 7.0).

1/12 to 1/15 FS (File Separator, GS (Group Separator), RS (Record Separator), and US (Unit Separator): These information separators may be used within data in optional fashion, except that their hierarchical relationshipshall be: FS in the most inclusive, then GS, then RS, and US in least inclusive. (The content and length of a File, Group, Record, or Unit are not specified.)

7/15 DEL (Delete): A character used primarily to erase or obliterate an erroneous or unwanted character in punched tape. DEL characters may also serve to accomplish media-fill or time-fill. They may be inserted into or removed from a stream of data without affecting the information content of that stream but then the addition or removal of these characters may affect the information layout and/or the control of equipment.

SP (Space): A graphic character that is usually represented by a blank site in a series of graphics. The space character, though not a control character, has a function equivalent to that of a format effector that causes the active position to move one position forward without producing the printing or display of any graphic. Similarly, the space character may have a function equivalent to that of an information separator.

No specific meaning is prescribed for any of the graphics in the code table except that which is understood by the users. Furthermore, this standard does not specify a type style for the printing or display of the various graphic characters. In specific applications, it may be desirable to employ distinctive styling of individual graphics to facilitate their use for specific purposes.

6. GENERAL CONSIDERATIONS

6.1 This standard does not define the means by which the coded set is to be recorded in any physical medium, nor does it include any redundancy or define techniaques for error control. Further, this standard does not define data communication character structure, data communication formats, code extension techniques, or graphic representation of control characters.

6.2 Deviations from the standard may create serious difficulties in information interchange and should be used only with full cognizance of the parties involved.

6.3 Where there is no application dependent requirement that determines the results of relative high-low magnitude comparison, and the control and graphic characters of this standard are used in data items involved in comparison operations; the results of all relative high-low magnitude comparisons shall be determined by the binary values of their bit patterns as a default condition. In this default condition the Null character (position 0/0) will be ranked low and the Delete Character (position 7/15) will be ranked high.

In a like manner where there is no application dependent collating sequence, the default collating sequence for the arrangement of files shall be determined by the binary values of the bit patterns of the sort keys.

6.4 The representation of this 7-bit code in an 8-bit environment is specified in the standard on code extension (see section 7.0).

6.5 The appendixes to this standard contain additional information on the design and use of this code.

7.0 RELATED STANDARDS

X3L2/1199	pANS Code Extension Techniques for Use with the 7-Bit Coded Character Set of ASCII.
DIS/2022	Code Extension Techniques for Use With the 7-Bit Coded Character Set of ISO/R646.
DIS/R646	7-Bit Coded Character Set for Information Processing Interchange.

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Doc. No. X3L2/1286
Date 72/10/20
Project 12

COMMITTEE CORRESPONDENCE

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Memorandum To: X3L2 Members and Alternates

Subject: Proposed Revision of Appendix for ASCII

Attached is a proposed revision of the Appendix for ASCII that reflects the changes agreed upon at the X3L2 meeting in Cleveland. The sections changed are marked in the margin, and the major ones are as follows:

A5.3 The example of stylization of Exclamation Point and Circumflex into Logical OR and Logical NOT was moved here from section 6.4 and rewritten.

A6.10 The statement about the digits 10 and 11 for sterling monetary representation was removed from the end of this section and also section C2.6.

A7.6 This was rewritten to reflect New Line as the primary use of position 0/10 and Line Feed as the secondary use.

B4. This was extended to allow for the replacement of the Dollar Sign by the Currency Symbol (¤).

D. The definition of Active Position was added to the list of terms.

The only other change outstanding is a rewrite of the last paragraph of section A7.2 which John Booth is to supply.

Hubert
H. F. Ickes

HFI/jan

Appendixes

(These Appendixes are not a part of USA Standard Code for Information Interchange, X3.4-1968, but are included to facilitate its use.)

Appendix A

Design Considerations for the Coded Character Set

A1. Introduction

The standard coded character set is intended for the interchange of information among information processing systems, communication systems, and associated equipment.

A2. Considerations Affecting the Code

There were many considerations that determined the set size, set structure, character selection, and character placement of the code. Among these were (not listed in order of priority):

(1) Need for adequate number of graphic symbols

(2) Need for adequate number of device controls, format effectors, communication controls, and information separators

(3) Desire for a non-ambiguous code, i.e., one in which every code combination has a unique interpretation

(4) Physical requirements of media and facilities

(5) Error control considerations

(6) Special interpretation of the all-zeros and all-ones characters

(7) Ease in the identification of classes of characters

(8) Data manipulation requirements

(9) Collating conventions
    (a) Logical
    (b) Historical

(10) Keyboard conventions
    (a) Logical
    (b) Historical

(11) Other set sizes

(12) International considerations

(13) Programming languages

(14) Existing coded character sets.

A3. Set Size

A 7-bit set is the minimum size that will meet the requirements for graphics and controls in applications involving general information interchange.

A4. Set Structure

A4.1 In discussing the set structure it is convenient to divide the set into 8 columns and 16 rows as indicated in this standard.

A4.2 It was considered essential to have a dense subset which contained only graphics. For ease of identification this graphic subset was placed in six contiguous columns.

A4.3 The first two columns were chosen for the controls for the following three reasons:

(1) The character NUL by its definition has the location 0/0 in the code table. NUL is broadly considered a control character.

(2) The representations in column 7 were felt to be most susceptible to simulation by a particular class of transmission error—one which occurs during an idle condition on asynchronous systems.

(3) To permit the considerations of graphic subset structure described in A6 to be satisfied, the two columns of controls had to be adjacent.

A4.4 The character set was structured to enable the easy identification of classes of graphics and controls.

A5. Choice of Graphics

A5.1 Included in the set are the digits 0 through 9, upper and lower cases of the alphabetic letters A through Z, and those punctuation, mathematical, and business symbols considered most useful. The set includes a number of characters commonly encountered in programming languages. In particular, all the COBOL and FORTRAN graphics are included.

A5.2 In order to permit the representation of languages other than English, one diacritical (or accent) mark has been included, and provision has been made for the use of five punctuation symbols alternately as diacritical marks. The pairing of these punctuation symbols with their corresponding diacritical marks was done to facilitate the design of a typeface which would be acceptable for both uses.

These arrangements are:

Col/Row	Code Table Symbol	Use: Punctuation	Use: Diacritical
2/2	"	Quotation Marks	Diaeresis
2/7	´	Apostrophe	Acute Accent
2/12	,	Comma	Cedilla
5/14	^	(None)	Circumflex
6/0	`	Opening Single Quotation Mark	Grave Accent
7/14	~	Overline	Tilde*

*May also be used for other accents not specifically provided.

A5.3 An example of graphic stylization that may be desirable in specific applications, as provided in Section 5.3), is the PL/I graphics Logical OR and Logical NOT. These two graphics are provided by stylizing the Exclamation Point (position 2/1) and the Circumflex (position 5/14) into the Logical OR (|) and Logical NOT (¬) respectively.

A6. GRAPHIC SUBSET STRUCTURE

A6.1 The basic structure of the dense graphic subset was influenced by logical collating considerations, the requirements of simply related 6-bit sets, and the needs of typewriter-like devices. For information processing, it is desirable that the characters be arranged in such a way as to minimize both the operating time and the hardware components required for ordering and sequencing operations. This requires that the relative order of characters, within classes, be such that a simple comparison of the binary codes will result in information being ordered in a desired sequence.

A6.2 Conventional usage requires that SP *(space)* be ahead of any other symbol in a collatable set. This permits a name such as "JOHNS" to collate ahead of a name such as "JOHNSON." The requirement that punctuation symbols such as *comma* also collate ahead of the alphabet ("JOHNS, A" should also collate before "JOHNSON") establishes the special symbol locations, including SP, in the first column of the graphic subset.

A6.3 To simplify the design of typewriter-like devices, it is desirable that there be only a common 1-bit difference between characters to be paired on keytops. This, together with the requirements for a contiguous alphabet, and the collating requirements outlined above, resulted in the placement of the alphabet in the last four columns of the graphic subset and the placement of the numerals in the second column of the graphic subset.

A6.4 It is expected that devices having the capability of printing only 64 graphic symbols will continue to be important. It may be desirable to arrange these devices to print one symbol for the bit pattern of both upper and lower case of a given alphabetic letter. To facilitate this, there should be a single bit difference between the upper and lower case representations of any given letter. Combined with the requirement that a given case of the alphabet be contiguous, this dictated the assignment of the alphabet, as shown, in columns 4 through 7.

A6.5 To minimize ambiguity caused by the use of a 64-graphic device as described above, it is desirable, to the degree possible, that each character in column 6 or 7 differ little in significance from the corresponding character in column 4 or 5. In certain cases, this was not possible.

A6.6 The assignment of *reverse slant* and *vertical line*, the *brackets* and *braces*, and *circumflex* and *overline* were made with a view to the considerations of A6.5.

A6.7 The resultant structure of "specials" (S), "digits" (D), and "alphabetics" (A) does not conform to the most prevalent collating convention (S-A-D) because of other more demanding code requirements.

A6.8 The need for a simple transformation from the set sequence to the prevalent collating convention was recognized, and dictated the placement of some of the "specials" within the set. Specifically, those special symbols, viz., *ampersand* (&), *asterisk* (*), *comma* (,), *hyphen* (-), *period* (.), and *slant* (/), which are most often used as identifiers for ordering information and which normally collate ahead of both the alphabet and the numerals, were not placed in the column containing the numbers, so that the entire numeric column could be rotated via a relatively simple transformation to a position higher than the alphabet. The sequence of the aforementioned "specials" was also established to the extent practical to conform to the prevalent collating convention.

A6.9 The need for a useful 4-bit numeric subset also played a role in the placement of characters. Such a 4-bit subset, including the digits and the symbols *asterisk*, *plus* (+), *comma*, *hyphen*, *period*, and *slant*, can easily be derived from the code.

A6.10 Considerations of other domestic code sets, including the Department of Defense former standard 8-bit data transmission code ("Fieldata"-1961), as well as international requirements, played an important role in deliberations that resulted in the code. The selection and grouping of the symbols *dollar sign* ($), *percent* (%), *ampersand* (&), *apostrophe* ('), *less than* (<), *equals* (=), and *greater than* (>) facilitate contraction to either a business or scientific 6-bit subset. The position of these symbols, and of the symbols *comma*, *hyphen*, *period*, and *slant*, facilitates achievement of commonly accepted pairing on a keyboard. The historic pairing of *question mark* and *slant* is preserved and the *less than* and *greater than* symbols, which have comparatively low usage, are paired with *period* and *comma* so that in dual-case keyboard devices where it is desired to have *period* and *comma* in both cases, the *less than* and *greater than* symbols are the ones displaced. Provision was made for the accommodation of alphabets containing more than 26 letters and for 6-bit contraction by the location of low-usage characters in the area following the alphabet.

ontrol Subset Content and Structure

7.1 The control characters included in the set are those required for the control of terminal devices, input and output devices, format, or communication transmission and switching on a general enough basis to justify inclusion in a standard set.

A7.2 Many control characters may be considered to fall into the following categories:

(1) Communication Controls
(2) Format Effectors
(3) Device Controls
(4) Information Separators.

To the extent practical controls of each category were grouped in the code table. The structure chosen also facilitates the contraction of the set to a logically related 6-bit set.

A7.3 The information separators (FS, GS, RS, US) identify boundaries of various elements of information, but differ from punctuation in that they are primarily intended to be machine sensible. They were arranged in accordance with an expected hierarchical use, and the lower end of the hierarchy is contiguous in binary order with SP (space) which is sometimes used as a machine-sensible separator. Subject to this hierarchy the exact nature of their use within data is not specified..

A7.4 The character SYN (Synchronous Idle) was located so that its binary pattern in serial transmission was unambiguous as to character framing, and also to optimize certain other aspects of its communication usage.

A7.5 ACK (Acknowledge) and NAK (Negative Acknowledge) were located so as to gain the maximum practical protection against mutation of one into the other by transmission errors.

A7.6 The function "New Line" (NL) has been assigned as the principal control function to position 0/10 and "Line Feed" (LF) assigned as the secondary function. This has been incorporated in the standard to reflect the trend to a single function to perform the new line function. These assignments allow the use of a common end-of-line format for both printers having separate CR-LF functions and those having a combined (i.e., NL) function. This sequence would be CR-LF, producing the same result on printers of both classes, and would be useful during conversion of a system from one method of operation to the other.

Appendix B

Notes on Application

B1. Introduction

B1.1 The standard code was developed to provide for information interchange among information processing systems, communications systems, and associated equipment. In a system consisting of equipment with several local or native codes, maximum flexibility will be achieved if each of the native codes is translated to the standard whenever information interchange is desired.

B1.2 Within any particular equipment, system, or community of activity, it may be necessary to substitute characters. For example, some systems may require special graphic symbols and some devices may require special control codes. (Design efforts on the standard code included consideration of these types of adaptations.) So-called "secular sets" produced by such substitutions, although not conforming to this standard, may nonetheless be consonant with it if substitutions are made in accordance with the guidelines of B2.

B2. Character Substitutions

B2.1 Any character substitution will result in a coded character set which does not conform to this standard.

B2.2 It is recommended that when a character is substituted in the code table for a standard character, the standard character should not be reassigned elsewhere in the table. Such a substitute character, once assigned, should not be subsequently reassigned elsewhere.

B2.3 It is recommended that graphic substitutions be made only in the graphic area and control substitutions only in the control area. Any substitution involving a control should be made only with full cognizance of all possible operational effects.

B2.4 It should be noted that this standard specifies, for each position of the code table, the information represented by the character and not necessarily the precise action taken by the recipient when the character is received. In the case of graphics, considerable variation in the actual shape printed or displayed may be appropriate to different units, systems, or fields of application. In the case of controls, the action performed is dependent upon the use for which the particular system is intended, the application to which it is being put, and a number of conventions established by the user or designer—some system-wide and some unique to a particular unit.

5 Typical examples of diversity in execution not ecessarily contrary to this standard are:

(1) A number of graphic symbols, other than that used in the code table, are used for *ampersand* in various type styles; still other symbols may be more appropriate to electronic display devices. The use of such alternate symbols does not in itself constitute deviation from the standard as long as *ampersand* is the concept associated with the character. Note that this does not necessarily restrict the use of such an alternate symbol design to mean "*and*"; in any type style *ampersand* may, of course, be used with arbitrary meaning.

(2) A card punch in one application may "skip" when the character HT (Horizontal Tabulation: used as skip) is presented to it; in another application the character HT may be recorded in the card without further action.

B3. Related Larger and Smaller Sets

Consideration has been given to the relationship between the standard set and sets of other sizes. A number of straightforward logical transformations are possible which result in a variety of sets related to the standard. None of the transformed sets are recognized by this standard.

B4. International Considerations

This standard conforms to the recommendations of the International Organization for Standardization (ISO) and the International Telegraph and Telephone Consultative Committee (CCITT)* for a 7-bit code. It includes all the character assignments specified by those bodies for international standardization. Their recommendations, however, permit national standardization by the various countries in seven code table positions. Also, the characters in three additional positions have been designated as being replaceable by national characters in only those countries having an extraordinary requirement in this regard.

The seven national usage positions and their assignments in this standard are shown in the following, as well as the three "supplementary" national use positions, which are denoted by an asterisk:

Column/Row	Character (U.S.)
4/0	@
5/11	[
5/12	\
5/13	]
* 5/14	^
* 6/0	`
7/11	{
7/12	¦
7/13	}
* 7/14	~

In international interchange of information these 10 characters should not be used except where it is determined that there is agreement between sender and recipient.

In addition, in other countries, the number sign (#) (in position 2/3) may be replaced by "£", and the Dollar Sign ($) (in position 2/4) may be replaced by the Currency Symbol (¤).

B5. Communications Considerations

Certain control characters are designated as "communication controls." They are:

SOH	(Start of Heading)
STX	(Start of Text)
ETX	(End of Text)
EOT	(End of Transmission)
ENQ	(Enquiry)
ACK	(Acknowledge)
DLE	(Data Link Escape)
NAK	(Negative Acknowledge)
SYN	(Synchronous Idle)
ETB	(End of Transmission Block)

These may be used by communication systems for their internal signaling, or for the exchange of information relating to the control of the communication system between that system and its end terminals. Some such systems may impose restrictions on the use of these communication control characters by the end terminals. For example, the use of some of them may be completely prohibited while others may be restricted to use in conformity with the formats and procedures required by the communication system for its operation.

Appendix C

Original Criteria

C1. Introduction

C1.1 This Appendix contains the original criteria upon which the design of the code was based. Not all criteria have been entirely satisfied. Some are conflicting, and the characteristics of the set represent accepted compromises of these divergent criteria.

C1.2 The criteria were drawn from communication, processing, and media recording aspects of information interchange.

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*An international body which establishes standards and conventions for international telecommunications, especially where the public telegraph and telephone services are governmentally owned and operated. Their recommendations are often embodied in the regulations applying to such services.

C2. Criteria

C2.1 Every character of the code set shall be represented by the same number of bits (i.e., binary digits).

C2.2 The standard set shall be so structured as to facilitate derivation of logically related larger or smaller sets.

C2.3 In a code of *n* bits, all possible 2^n patterns of ones and zeros will be permitted and considered valid.

C2.4 The number of bits, *n*, shall be sufficient to provide for the alphabetic and numeric characters, commonly used punctuation marks, and other special symbols, along with those control characters required for interchange of information.

C2.5 The digits 0 through 9 shall be included within a 4-bit subset.

C2.6 The digits 0 through 9 shall be so represented that the four low-order bits shall be the binary-coded-decimal form of the particular numeral that the code represents.

C2.7 The interspersion of control characters among the graphic characters shall be avoided. The characters devoted to controls shall be easily separable from those devoted to graphics.

C2.8 Within the standard set, each character shall stand by itself and not depend on surrounding characters for interpretation.

C2.9 An entire case of the alphabet (A through Z) shall be included within a 5-bit subset. Consideration shall be given to the need for more than 26 characters in some alphabets.

C2.10 The letters of each case of the alphabet shall be assigned, in conventional order (A through Z), to successive, increasing binary representations.

C2.11 Suitable control characters required for communication and information processing shall be included.

C2.12 Escape functions that provide for departures from the standard set shall be incorporated.

C2.13 A simple binary comparison shall be sufficient to determine the order within each class of characters. (In this regard, the special graphics, the numerals, and the alphabet are each defined as distinct classes.) Simple binary rules do not necessarily apply between classes when ordering information.

C2.14 Space (i.e., the space between words) must collate ahead of all other graphics.

C2.15 Special symbols used in the ordering of information must collate ahead of both the alphabet and the numerals.

C2.16 Insofar as possible, the special symbols shall be grouped according to their functions; for example, punctuation and mathematical symbols. Further, the set shall be so organized that the simplest possible test shall be adequate to distinguish and identify the basic alphabetic, numeric, and special symbol subsets.

C2.17 Special symbols shall be placed in the set so as to simplify their generation by typewriters and similar keyboard devices This criterion means, in effect, that the codes for pairs of characters that normally appear on the same keytops on a typewriter shall differ only in a common single-bit position.

C2.18 The set shall contain the graphic characters of the principal programming languages.

C2.19 The codes for all control characters shall contain a common, easily recognizable, bit pattern.

C2.20 The Null (000...) and Delete (111...) characters shall be provided.

Appendix D

Terminology

This Appendix is intended to clarify the sense in which certain terms are used.

Bit: Contraction of "binary digit."

Bit Pattern: The binary representation of a character.

ACTIVE POSITION: That character position in which the character about to be processed would appear. The active position normally advances one character position at a time.

Character: A member of a coded character set; the binary representation of such a member and its graphic symbol or control function.

Code: A system of discrete representation of a set of symbols and functions.